Claims

Sub A2

1. (Amended) A method for displaying a color image comprising the steps of:

illuminating a multilevel optical phase element with a light source having a plurality of wavelengths of interest, said multilevel phase element dispersing light from said light source by diffraction and focusing the dispersed light onto an imaging plane; and actuating a light modulating display in the imaging plane having a plurality of pixel elements, each said pixel element assigned to transmit a predetermined spectral region, within the near field region of said multilevel display element so as to receive said dispersed and focused light from said multilevel optical phase element.

Sub B1 claim 1

2. The method of claim 1 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\frac{T^2}{3\lambda_{Long}} < Z < \frac{2T^2}{3\lambda_{Short}}$$

wherein T is the periodicity of said multilevel optical phase element, λ_{Long} is the longest wavelength of said plurality of wavelengths of interest and λ_{Short} is the shortest wavelength of said plurality of wavelengths of interest.

3. (Amended) The method of claim 1 further comprising providing a light source having a polychromatic spectrum.

Sub A3

4. (Amended) The method of claim 1 further comprising providing a plurality of subsources each subsource having a different spectral distribution.

5. (Amended) The method of claim 4 further comprising emitting light from each said subsource with a light emitting diode.

6. (Amended) The method of claim 4 further comprising providing a laser as each said subsource.

Sub A3

7. (Amended) The method of claim 1 further comprising providing a multilevel optical phase element that is multilevel in two othogonal directions.

Sub B5

8. The method of claim 2 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\frac{T^2}{3\lambda_{Long}} < Z < \frac{2T^2}{3\lambda_{Short}}$$

wherein T is the periodicity of said multilevel optical phase element, λ_{Long} is the longest wavelength of said plurality of wavelengths of interest and λ_{Short} is the shortest wavelength of said plurality of wavelengths of interest.

9. The method of claim 2 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\frac{T^2}{3\lambda_{Long}} < Z < \frac{T^2}{3\lambda_{Short}}$$

wherein T is the periodicity of said multilevel optical phase element, λ_{Long} is the longest wavelength of said plurality of wavelengths of interest and λ_{Short} is the shortest wavelength of said plurality of wavelengths of interest.

10. (Amended) A method for displaying a color image comprising the steps of:

focusing light, from a light source having a plurality of wavelengths of interest, using a plurality of focusing elements;

illuminating a multilevel optical phase element with light focused by said plurality of focusing elements, said multilevel phase element dispersing light from said plurality of focusing elements by diffraction and focusing the dispersed light onto an imaging plane; and

actuating a light modulating display in the imaging plane having a plurality of pixel elements, each said pixel element assigned to transmit a predetermined spectral region, so as to receive said dispersed light from said multilevel optical phase element.

11. (Amended) The method of claim 10 further comprising providing said plurality of focusing elements including a plurality of lenslets and wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\left[\frac{T^2 Z_S}{3\lambda_{long} Z_s - T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}\right]$$

$$\frac{2T^2 Z_s}{3\lambda_{long} Z_s - 2T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}$$

wherein T is the periodicity of said multilevel optical phase element, Z_s is equal to the distance between said multilevel optical phase element and said lenslets minus the focal length of said lenslets.

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12. The method of claim 11 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\left[\frac{T^2 Z_s}{3\lambda_{long} Z_s - T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}\right]$$

$$\frac{2T^2 Z_s}{3\lambda_{long} Z_s - 2T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}$$

Sub F1 cont.

wherein T is the periodicity of said multilevel optical phase element, Z_s is equal to the distance between said multilevel optical phase element and said lenslets minus the focal length of said lenslets.

14. The method of claim 11 wherein said multilevel optical phase element is constructed such that a magnification produced by said plurality of lenslets produces an dispersion element of a size substantially equal to the dimensions of each pixel element in said display.

15. The method of claim 14 wherein said magnification (M) is given by the equation:

$$M = 1 + \frac{Z}{Z_s}$$

wherein T is the periodicity of said multilevel optical phase element, Z_s is equal to the distance between said multilevel optical phase element and said lenslets minus the focal length of said lenslets and Z is the distance between said multilevel optical phase element and said display.

16. (Amended) A system for displaying a color image comprising:

a light source emitting a plurality of wavelengths of interest;

a multilevel optical phase element positioned to receive light from said light source, said multilevel phase element dispersing light from said light source by diffraction and focusing the dispersed light onto an imaging plane; and

a light modulating electronic display positioned in the imaging plane and having a plurality of pixel elements, each said pixel element assigned to transmit a predetermined spectral region, positioned within the near field region of said multilevel optical phase so as to receive said dispersed light from said multilevel phase element.

17. The system of claim 16 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

Sub A2 cont.

$$\frac{T^2}{3\lambda_{Long}} < Z < \frac{2T^2}{3\lambda_{Short}}$$

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wherein T is the periodicity of said multilevel optical phase element, λ_{Long} is the longest wavelength of said plurality of wavelengths of interest and λ_{Short} is the shortest wavelength of said plurality of wavelengths of interest.

18. The system of claim 17 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\frac{2T^2}{3\lambda_{Long}} < Z < \frac{2T^2}{3\lambda_{Short}}$$

wherein T is the periodicity of said multilevel optical phase element, λ_{Long} is the longest wavelength of said plurality of wavelengths of interest and λ_{Short} is the shortest wavelength of said plurality of wavelengths of interest.

19. The system of claim 17 wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\frac{T^2}{3\lambda_{Long}} < Z < \frac{T^2}{3\lambda_{Short}}$$

wherein T is the periodicity of said multilevel optical phase element, λ_{Long} is the longest wavelength of said plurality of wavelengths of interest and λ_{Short} is the shortest wavelength of said plurality of wavelengths of interest.

Sub A2 cont'd.

20. (Amended) The system of claim 17 wherein said light source has a polychromatic spectrum.

21. The system of claim 16 wherein said light source comprises a plurality of subsources each subsource having a different spectral distribution.

22. The system of claim 21 wherein each said subsource is a light emitting diode.

23. The system of claim 21 wherein each said subsource is a laser.

24. The system of claim 16 wherein said multilevel optical phase element is multilevel in two othagonal directions.

25. (Amended) A system for displaying a color image comprising;

a light source having a plurality of wavelengths of interest;

a plurality of focusing elements positioned to focus light from said light source;

a multilevel optical phase element positioned to receive light focussed by said plurality of focusing elements, said multilevel phase element dispersing light from said plurality of focusing elements by diffraction and focusing the dispersed light onto an imaging plane; and

a light modulating electronic display positioned in the imaging plane and having a plurality of pixel elements, each said pixel element assigned to transmit a predetermined spectral

region, positioned so as to receive said dispersed light from said multilevel optical phase element.

26. (Amended) The system of claim 25 wherein said plurality of focusing elements comprises a plurality of lenslets and wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\left[\frac{T^2 Z_s}{3\lambda_{long} Z_s - T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}\right]$$

Sub A1 cont'd.

$$\frac{2T^2 Z_s}{3\lambda_{long} Z_s - 2T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}$$

wherein T is the periodicity of said multilevel optical phase element Z_s is equal to the distance between said multilevel optical phase element and said lenslets minus the focal length of said lenslets, λ_{long} is the largest wavelength of said plurality of wavelengths of interest; and λ_{short} is the shortest wavelength of said plurality of wavelengths of interest.

27. The system of claim 26 wherein said plurality of focusing elements comprises a plurality of lenslets and wherein said display is positioned at a distance Z from said multilevel optical phase element, wherein Z is determined by the relationship:

$$\frac{2T^2 Z_s}{3\lambda_{long} Z_s - 2T^2} < Z < \frac{2T^2 Z_s}{3\lambda_{short} Z_s - 2T^2}$$

wherein T is the periodicity of said multilevel optical phase element Z_s is equal to the distance between said multilevel optical phase element and said lenslets minus the focal length

of said lenslets, λ_{long} is the largest wavelength of said plurality of wavelengths of interest; and λ_{short} is the shortest wavelength of said plurality of wavelengths of interest.

28 ~~29~~. The system of claim 25 wherein said multilevel optical phase element is constructed such that a magnification produced by said plurality of lenslets produces an dispersion element substantially equal to the dimensions of each pixel element in said display.

29 ~~30~~. The system of claim 29 wherein said magnification (M) is given by the equation:

$$M = 1 + \frac{Z}{Z_s}$$

wherein T is the periodicity of said multilevel optical phase element, Z is the distance between the multilevel phase element and said display and Z_s is equal to the distance between said multilevel optical phase element and said lenslets minus the focal length of said lenslets.

30 ~~31~~. The system of claim 25 wherein said multilevel optical phase element is multilevel in two othagonal directions.

31 ~~32~~. The system of claim 25 wherein said light source comprises a plurality of subsources each subsource having a different spectral distribution.

32 ~~33~~. The system of claim 32 wherein each said subsource is a light emitting diode.

33 ~~34~~. The system of claim 32 wherein each said subsource is a laser.